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Aikens

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[54] **RECTILINEARALLY LATCHABLE ZERO INSERTION FORCE CONNECTOR**

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[51] **Int. Cl.**[4] **H01R 9/09**

[52] **U.S. Cl.** .... **339/75 MP**; 339/91 R; 339/176 MP

[58] **Field of Search** .... 339/91 R, 75 MP, 176 MP

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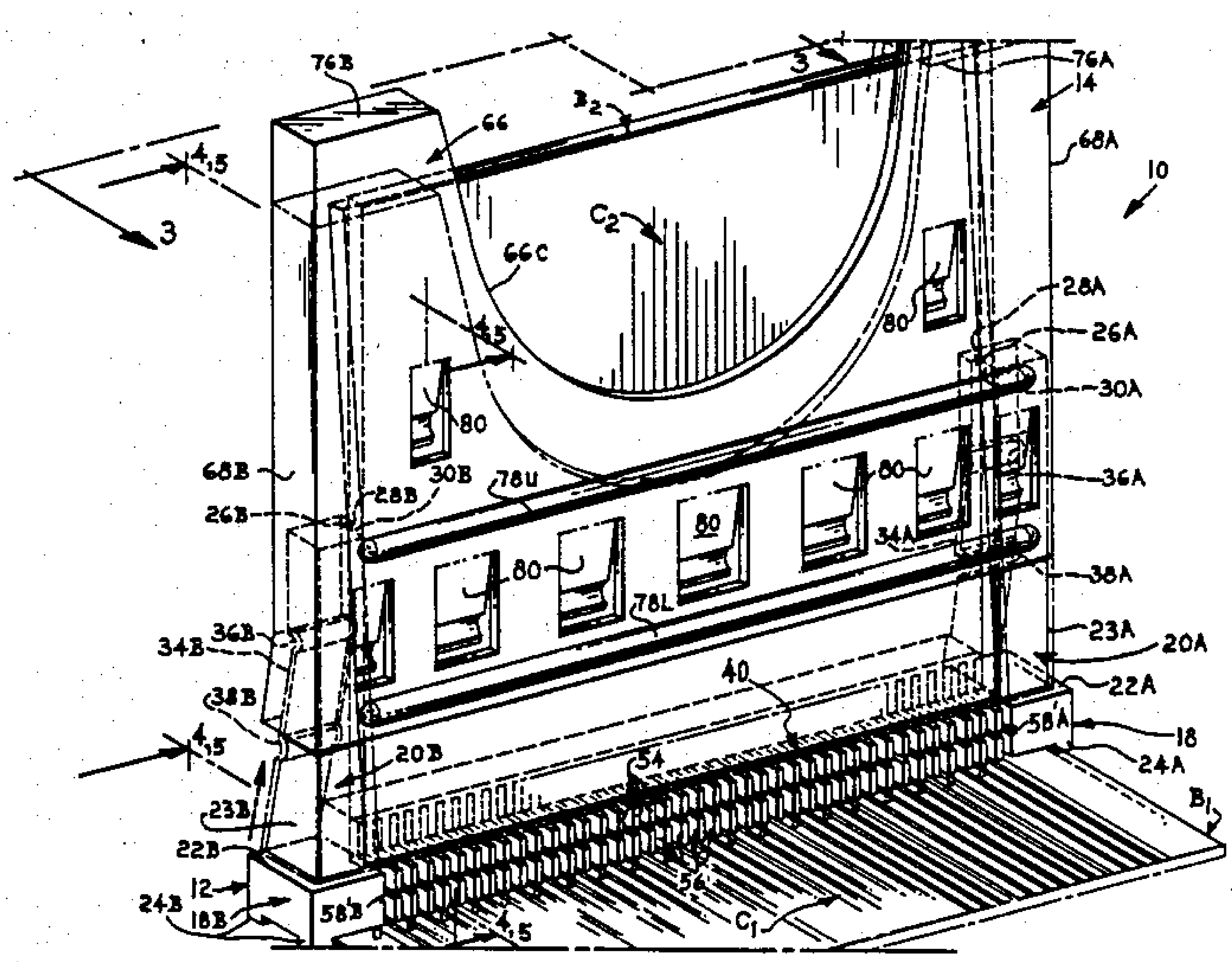
Primary Examiner—John McQuade

[57] **ABSTRACT**

A zero insertion force connector is provided with a housing and a latching member rectilinearly displacable with respect to the housing. A circuit board, receivable within the housing, is displaced with respect thereto from an initial to a final position in which the board abuts against a predetermined abutment surface on the housing. As the board is displaced, the final position of the board engages against a resilient contacting member which is successively urged in a first wiping direction across the conduction stripe on the board and thereafter, into a counter backwiping direction along the stripe.

10 Claims, 8 Drawing Figures



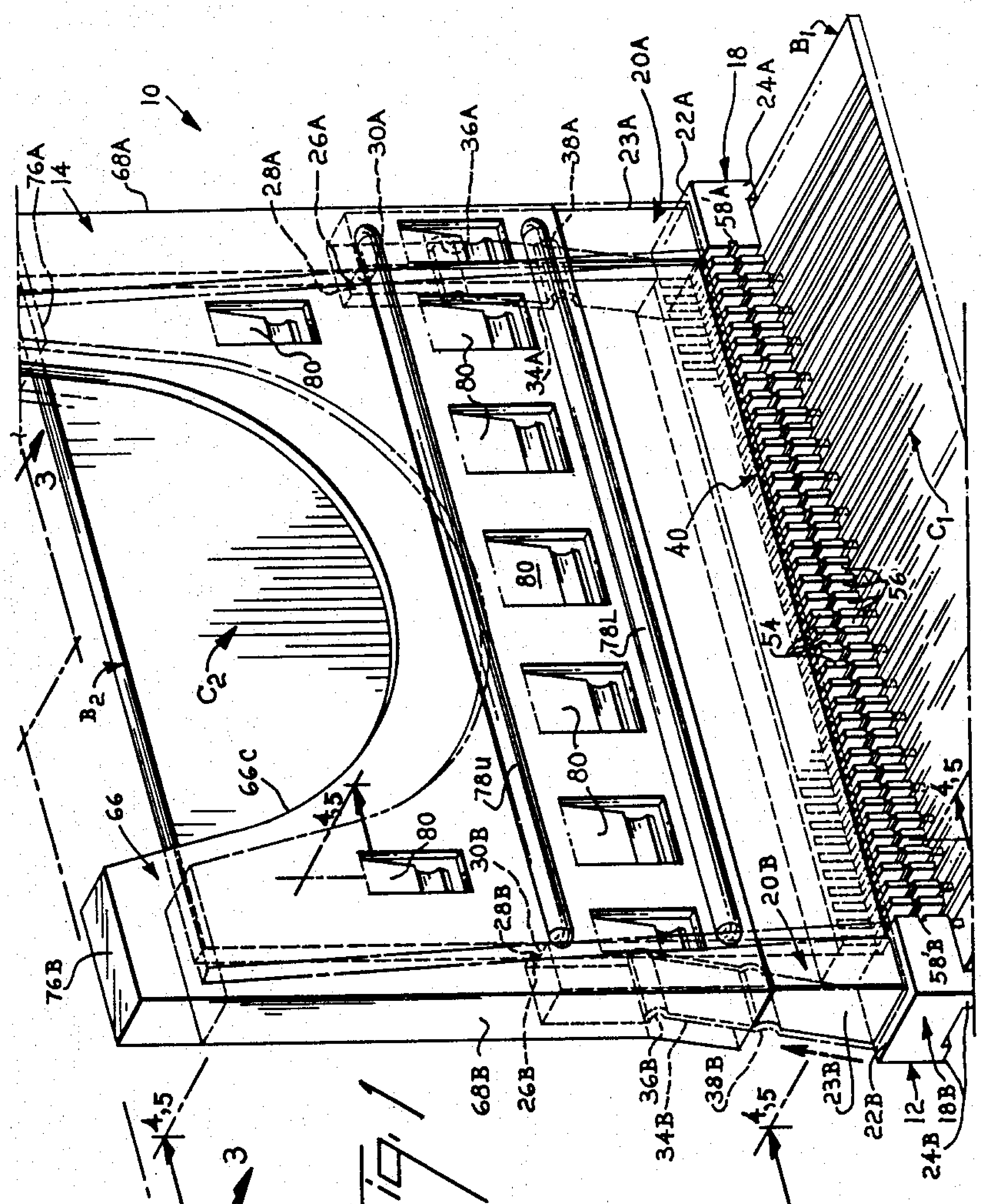
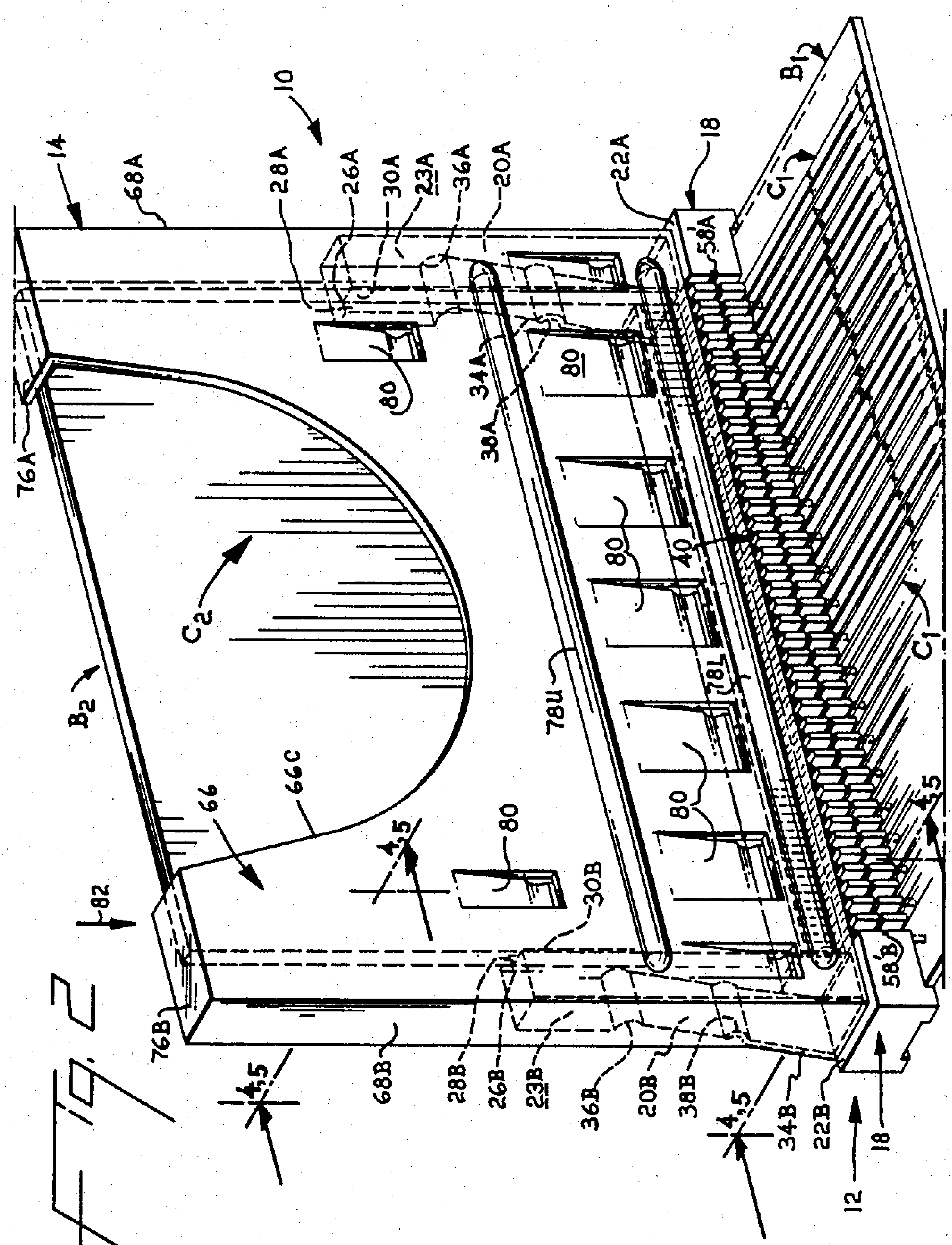


FIG. 1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14
68A
28A
26A
30A
23A
36A
20A
22A
18
B1
C1
58A
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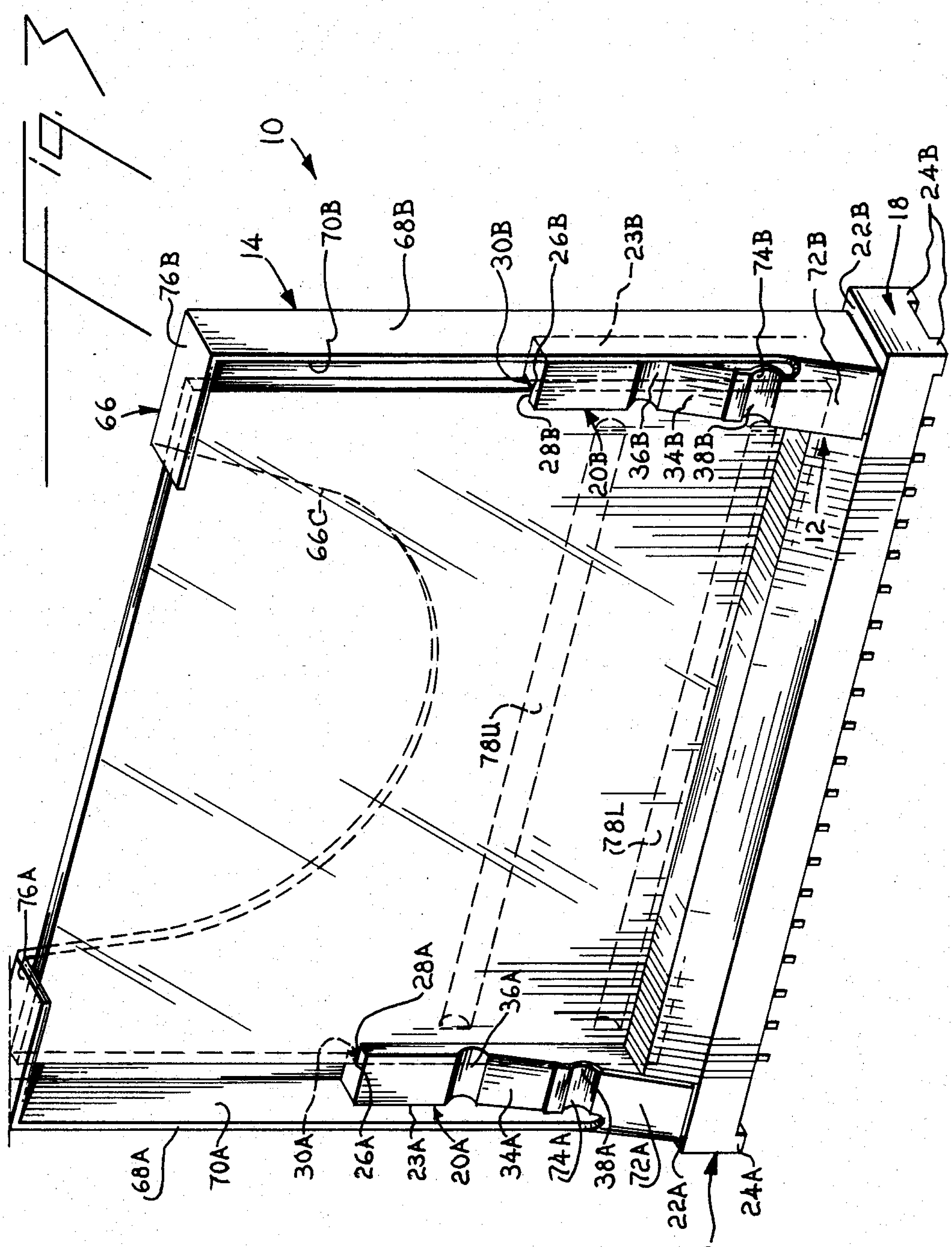
38A
40
C2
78U
78L
B2
66C
66
76A
82
4,5
30B
76B
68B
28B
26B
23B
36B
20B
38B
34B
22B
58B
12

Fig. 2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14
66
66C
68A
68B
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70B
76A
76B
30A
30B
26A
26B
28A
28B
23A
23B
20A
20B
34A
34B
36A
36B
74A
74B
38A
38B
72A
72B
22A
22B
24A
24B
18
12
78U
78L

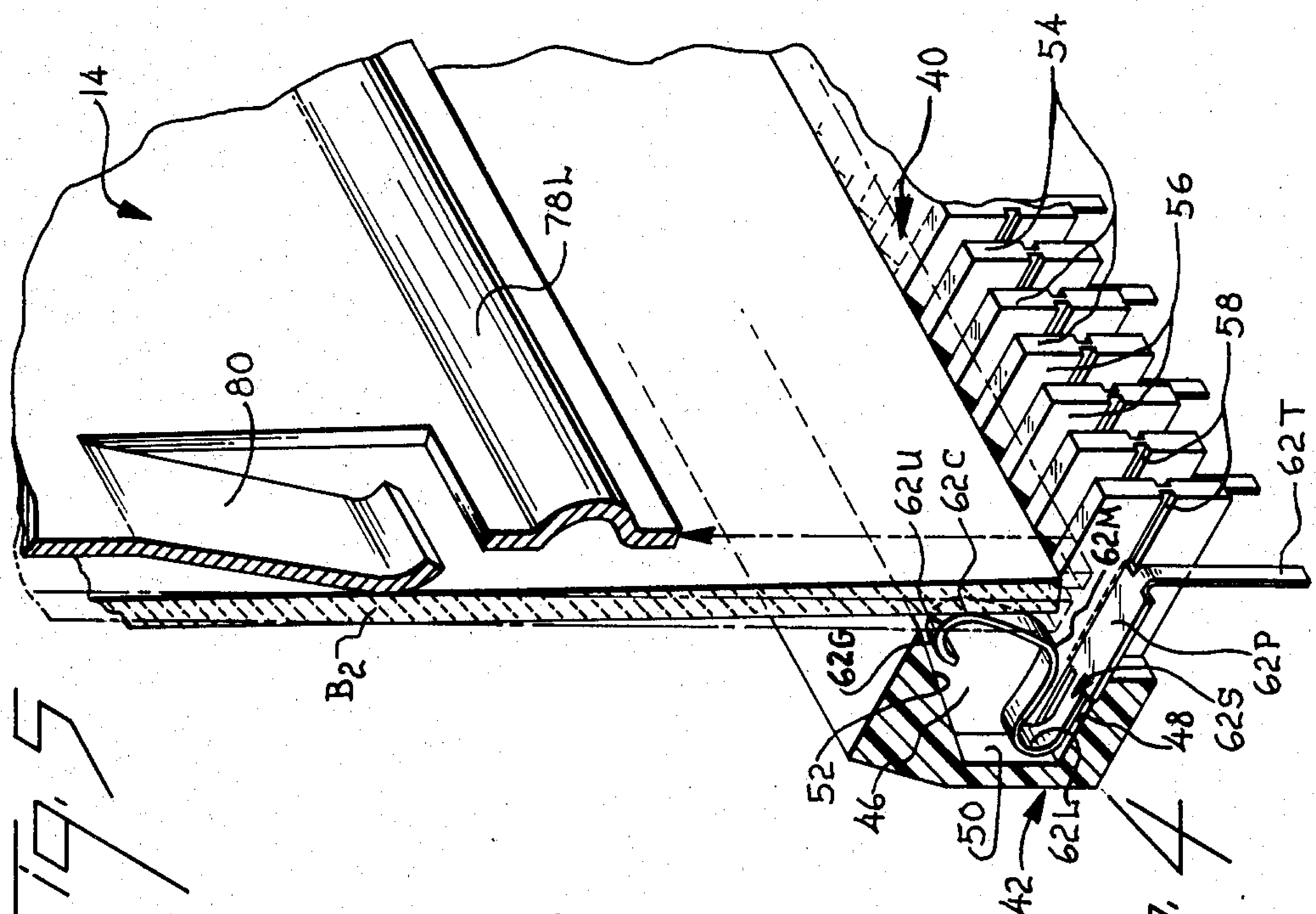
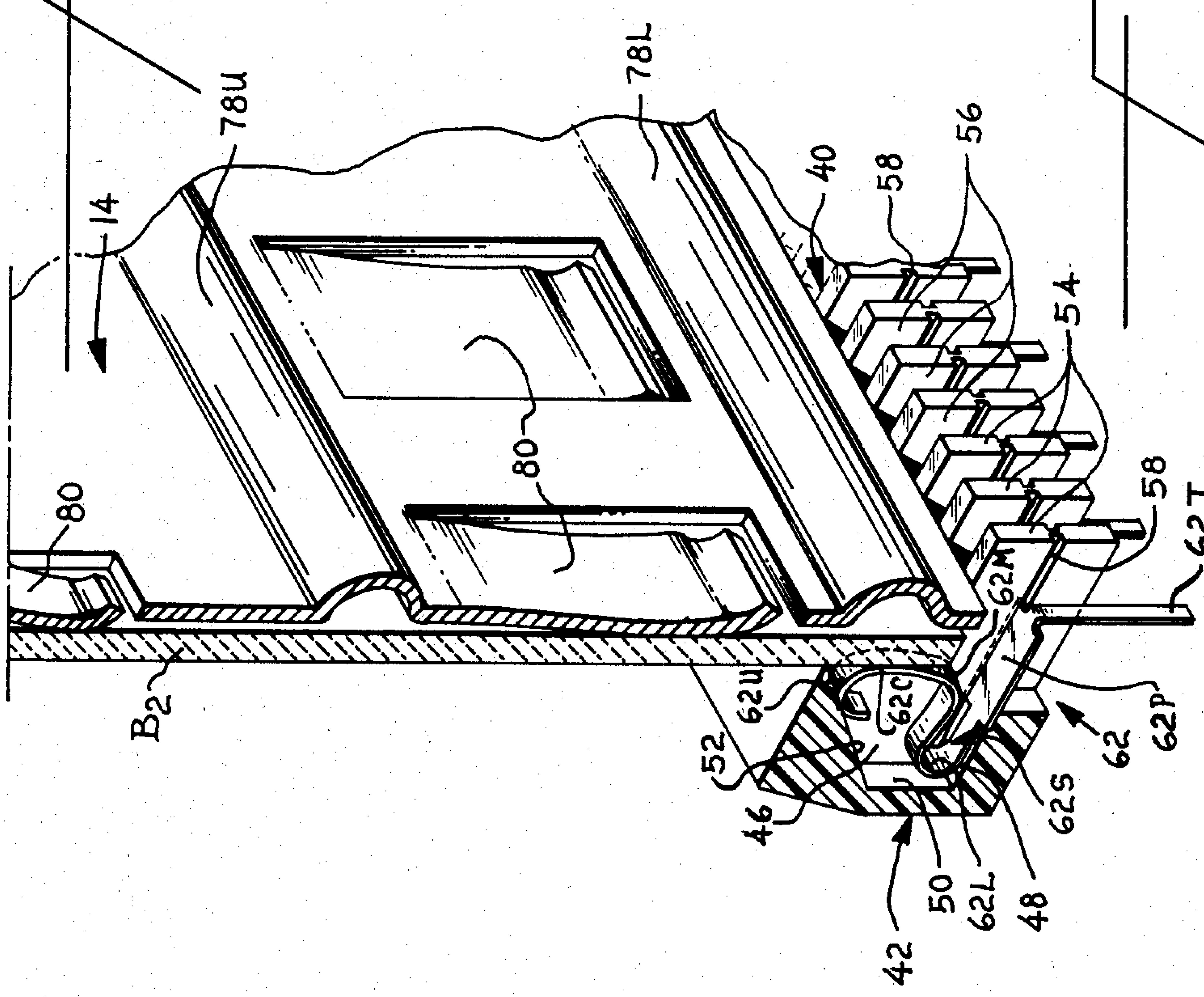

14
78L
80
40
54
56
58
62U
62C
62M
62T
B2
62G
52
46
50
42
62L
48
62S
62P

Fig. 5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78U
78L
40
58
56
54
80
80
58
62M
62T
B2
62U
62C
52
46
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62L
48
62S
62
62P

Fig. 4

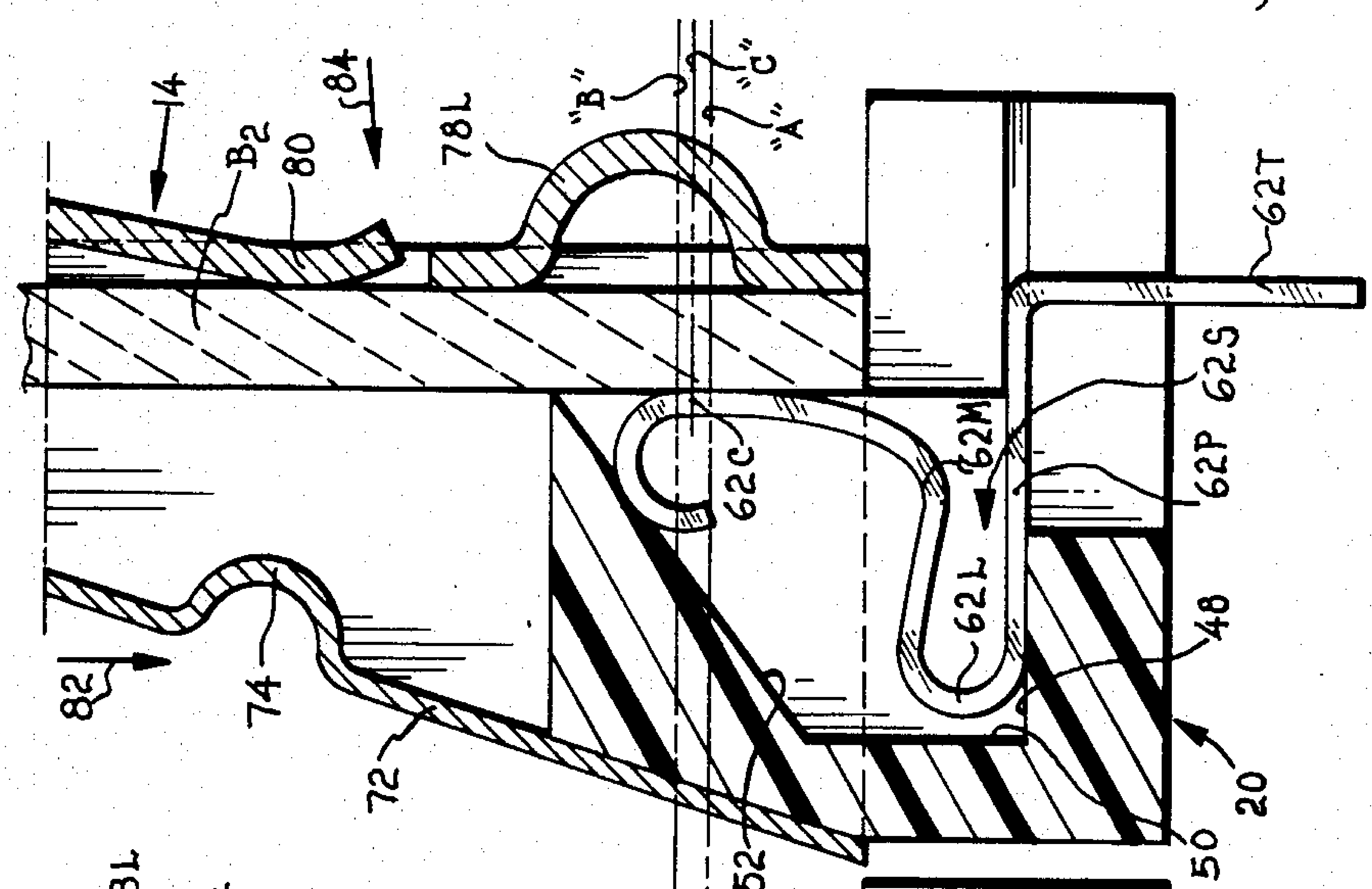

Fig. 8

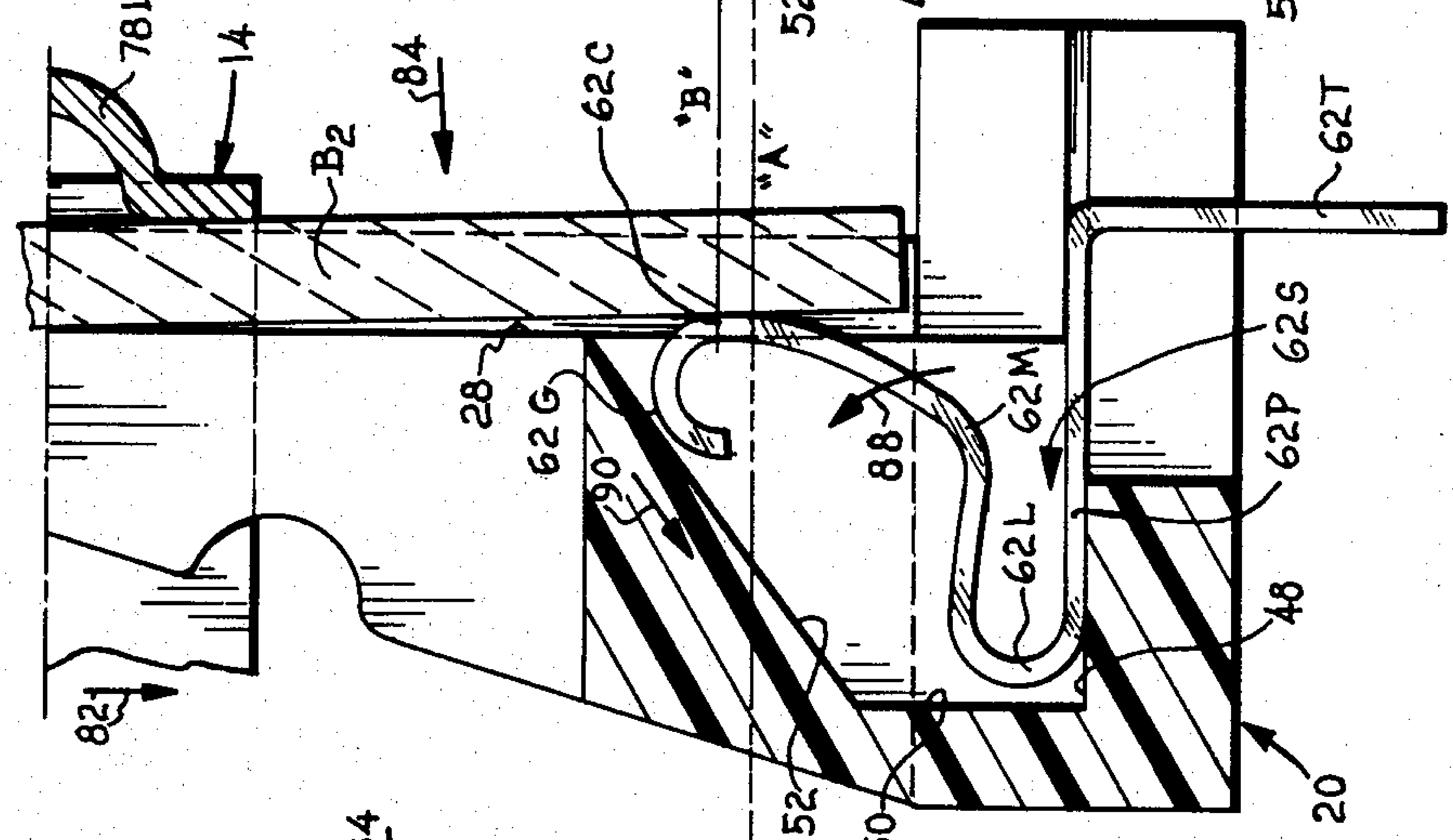

Fig. 7

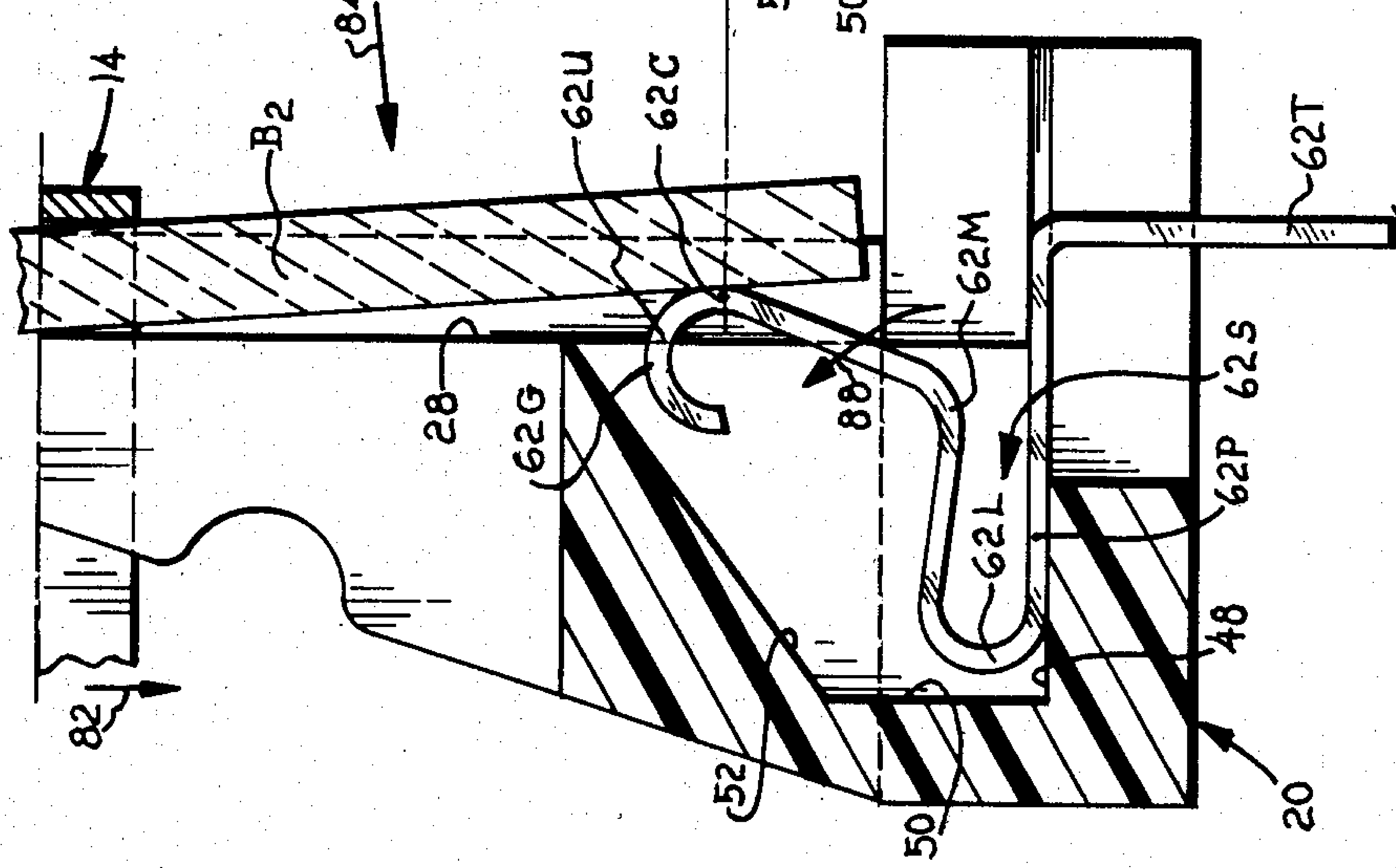

Fig. 6

RECTILINEARALLY LATCHABLE ZERO INSERTION FORCE CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a zero insertion force connector and, in particular, to a zero insertion force connector which is latched into position by rectilinear displacement of a latch with respect to the connector housing.

2. Description of the Prior Art

Connectors of the type which present substantially no opposition to the insertion of a circuit board or other substrate thereinto are known in the art as zero insertion force connectors. Such connectors eliminate frictional forces which tend to oppose the entry of a substrate into the connector. Such forces, when summed over the number of conduction paths on the substrate, present a not inappreciable opposite to the insertion of the substrate which could result in undue frictional wear on and premature failure of the conduction paths on the substrate.

Exemplary of known zero insertion force connectors is that shown in U.S. Pat. No. 4,266,839 (Aikens), assigned to the assignee of the present invention. This patent discloses a zero insertion force toggle link connector which utilizes a toggle rod and a substantially S-shaped spring contact arranged such that circular movement of the toggle rod in a first direction causes the spring contact to engage and wipe the conduction path on the substrate while reversal of the movement of the toggle rod causes the spring contact to disengage from the conduction path on the substrate.

Special problems are encountered when one is confronted with the problem of terminating and connecting printed circuit boards or other substrates provided on one side thereof with a ceramic or porcelain-on-steel finish. Ceramic surface printed circuit boards carry sharp edges which, if care is not exercised, may shear the pin contacts carried by the connector thus vitiating the connector for its intended purpose. Porcelain-on-steel printed circuit boards include an edge meniscus which must be overcome or avoided before the contacts on the connector may engage the conduction paths on the board. None of the known zero insertion force connectors in the art is believed able to accept and electrically engage the conduction paths on ceramic-surfaced or porcelain-on-steel printed circuit boards in a zero insertion force mode.

Accordingly, in view of the foregoing, it is believed advantageous to provide a zero insertion force connector which is especially adapted for accepting and electrically engaging conduction paths disposed on ceramic surfaced or porcelain-on-steel printed circuit boards.

SUMMARY OF THE INVENTION

The invention relates to a zero insertion force connector especially adapted for use with ceramic or porcelain-on-steel printed circuit boards. The connector includes a housing formed of a dielectric material which carries an array of resilient contacts disposed in a recessed portion of the housing. The contacts correspond in a one-to-one relationship with a conduction path on the board. The housing provides guide posts at each end of the housing, the guide posts having an abutment surface on one side thereof and an inclined cam surface having a detent groove on the opposed side thereof. A latch is slidably received on the guide post and is movable along the cam surface of each post from an open position to a latched position. An array of bias springs is provided on the latch. A ceramic or porcelain-on-steel circuit board is receivable into and supported by a planar shelf in the connector when the latch occupies the open position. Rectilinear displacement of the latch with respect to the guide posts on the housing from the open to the latched position causes a translating force to be generated by the bias springs and imposed onto the circuit board which tends to progressively displace the same from its initial position to a final position in which the board engages the abutment surface on the posts. As the board is urged toward the final position the board progressively engages and pivots each of the contacts with respect to the housing across the conduction path corresponding thereto in a first, wiping, direction. Further progressive advancement of the board to the abutting position sequentially thereafter causes the contacts to slide with respect to the housing along the guide surface in an opposing backwiping direction to thereby locate the contacts over a freshly wiped portion of the conduction path on the board.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more fully understood from the following detailed description thereof, taken in connection with the accompanying drawings which form a part of this application and in which:

FIG. **1** is a perspective view with zero insertion force connector in accordance with the present invention with the latch thereof in the open position with respect to housing;

FIG. **2** is a view similar to FIG. **1** illustrating the connector in accordance with the present invention with the latch in the latched position;

FIG. **3** is a perspective view of the latch taken substantially along view lines **3—3** in FIG. **1**;

FIG. **4** is an enlarged perspective view of the relationship of the circuit board and the contacts carried by the connector housing with the board in the initial position with respect to the housing;

FIG. **5** is a perspective view similar to FIG. **4** illustrating the circuit board in the final position with respect to the housing; and

FIGS. **6**, **7** and **8** are stylized diagrams illustrating the motion of the contacts with respect to the housing as the board is progressively moved with respect to the housing from the initial position to the final position.

DETAILED DESCRIPTION OF THE INVENTION

Throughout the following, detailed description similar reference numerals refer to similar elements in all figures of the drawings.

The zero insertion force connector generally indicated by reference character **10** comprises, in accordance with the present invention, a dielectric housing **12** adapted to cooperably receive a latch generally indicated by reference character **14**. The connector **10**, in its typical operating environment, is mounted on a first circuit board or other substrate B_1 having an array of conduction paths C_1 disposed thereon. The connector **10** is arranged to electrically engage conduction paths C_2 provided on a ceramic-surfaced or porcelain-on-steel circuit board B_2 such that each conduction path C_2 on the board B_2 is electrically interconnected with a corresponding conduction path C_1 on the board B_1. It is advantageous that the insertion of the board B_2 into the connector **10** encounter minimal insertion force for the reasons outlined above.

The housing **12** is formed of a suitable plastic dielectric material and includes a base portion **18** having upstanding posts **20A** and **20B** projecting from pedestals **22A** and **22B** disposed at each axial end thereof. The outer lateral surfaces of the posts **20** define guide surfaces **23A** and **23B**, respectively. The base **18** may be provided with suitable standoffs **24A** and **24B** to support the base above the surface of the board B_1.

The confronting faces of the posts **20A** and **20B** are notched, as at **26A** and **26B**, to define frontally facing board abutment surfaces **28A** and **28B** and associated board guide surfaces **30A** and **30B** which communicate with the respective board abutment surfaces **28A** and **28B**. The rear surface of each of the posts **20A** and **20B** has an inclined cam surface **34A** and **34B** arranged respectively thereon. The cam surface **34A** and **34B** is defined between a respective upper detent groove **36A** and **36B** and a lower detent groove **38A** and **38B**. The base is stepped, as at **40**, in that region between the confronting board guide surfaces **30A** and **30B**. The stepped portion **40** of the base **18** is notched or undercut, as at **42** (FIGS. **4** and **5**), to form in the main portion of the base **18** a contact receiving recess **46**. The recess **46** is defined by a support wall **48**, a back wall **50** and a camming wall **52** (FIGS. **4** and **5**). The portion of the base **18** projecting forwardly from the recess **46** is cut to form substantially parallel partitions **54** which cooperate to define an array of adjacent contact receiving regions **56**. The upper surfaces of each of the partitions **54** cooperate to define a substantially planar board support shelf.

Each of the partitions **54** is provided on each lateral surface thereof with grooves **58** (FIGS. **4** and **5**). The inward lateral face of each of the pedestals **22A** and **22B** is provided with a corresponding groove **58'A** and **58'B** (FIGS. **1** and **2**). Each pair of confronting grooves **58** (or groove **58** and confronting groove **58'A** and **58'B** in the case of the axially outermost grooves) is arranged to receive a generally flatened guide plate **62P** of a resilient electrically conductive contact member **62** (omitted from FIGS. **1** through **3** for clarity). The guide plate portion is supported on the support wall **48** of the recess **46**. One end of the guideplate **62P** has downwardly extending contacting tine **62T** depending therefrom. The depending tines **62T** are adapted for interconnection and electrical engagement with the conducting paths C_1 on the board B_1 in any suitable manner. The opposite end of the guideplate **62P** is connected to one free end of a substantially inverse-S-shaped section portion **62S**. The lower bend **62L** of the section **62S** confronts the back wall **50** of the recess **46**. A contacting surface portion **62C** is defined between the middle bend **62M** and the upper bend **62U** of the section **62S**. A guide surface **62G** (FIG. **4**) is defined along the upper outer surface of the section **62S**. In accordance with this invention and in a manner to be discussed in full detail herein a freshly wiped portion of the conduction strip C_2 on the board B_2 is brought into electrical contact with the contacting surface **62C** of the section **62S**.

In practice, the housing member above described may be suitably formed by injection molding or the like. An array of contacts **62**, each adhered to a leader strip, may be inserted such that edges of the guide plate portions **62P** of each are received in the appropriate ones of the grooves **58** (and **58'A** and **58'B** if appropriate). The leader may then be removed once each of the contacts **62** is in place within the base **18**. The appropriate board abutment surfaces **28A** and **28B** and board guide surfaces **30A** and **30B**, as well as cam surfaces **34A** and **34B** and latch grooves **36A** and **36B** and **38A** and **38B** may be appropriately machined into the housing **12**.

The latch **14** has a substantially planar body portion **66** which is provided with an accurate cutout **66C** for the purpose of facilitating manipulation of the board B_2. Opposed flaps **68A** and **68B** at each end of the planar body **66** are folded toward each other to define guide surfaces **70A** and **70B** (FIG. **3**), respectively. The guide surfaces **70A** and **70B** are arranged to closely lie against the respective guide surfaces **23A** and **23B** of the posts **20A** and **20B** as the latching member **14** is advanced rectilinearly with respect to the housing **12** in a manner to be discussed. The lowermost ends of the flaps **68A** and **68B** include latch tabs **72A** and **72B**. The latch tabs are themselves provided with a respective depression **74A** and **74B** adapted to form a latching detent engageable with either of the upper or lower latch grooves **36A** and **36B** and **38A** and **38B**. Flanges **76A** and **76B** defined between the cutout **66C** and the flaps **68A** and **68B** are bent perpendicularly to the body **66** to form cap flanges adapted to overlie the tops of the posts **20A** and **20B**, respectively, when the latch **14** is in a latched position. The body member **66** is corrugated, as **78U** and **78L** in order to impart structural rigidity thereto. An array of tongues **80** (omitted from FIG. **3** for clarity) is cut into the body portion **66**. The tongues **80** when depressed inwardly toward that region partially enclosed by the flaps **68A** and **68B** and the flanges **76A** and **76B** serve to form cantilevered bias springs which impart a resilient biasing force against the board B_2.

Typically, the latch **14** may be formed by stamping and cutting a planar piece of stock and thereafter folding the same to define the flaps **68A** and **68B**, tabs **72A** and **72B** and the flanges **76A** and **76B**.

In operation, with the latch **14** in the open position (FIG. **1**) the circuit board B_2 is introduced into the connector **10** such that the front of the circuit board B_2 (that is the surface of the board having conduction paths C_2 thereon) facing the respective abutment surfaces **28A** and **28B** on the posts **20A** and **20B**. The lateral edges of the board B_2 are confined and guided by the board guide surfaces **30A** and **30B** provided on each of the posts **20A** and **20B** respectively. The lower edge of the board B_2 lies on the planar shelf defined by the coplanar upper surfaces of each of the partitions **54**.

With the board B_2 inserted into the connector **12** into the initial position above described the board B_2 is inclined slightly with respect to the board abutment surface **28A** and **28B**. It is noted that the insertion of the board B_2 into the connector **10** occurs with no opposing insertion force. Moreover, due to the angulation or inclination of the board B_2, the tendency of a ceramic board to shear the contacting pin is avoided. Alternatively, if the board B_2 is a porcelain-on-steel board, the edge meniscus of such a board is effectively avoided, since that edge meniscus is supported on the planar shelf defined by the walls and the conduction paths adjacent the periphery of the board are more readily accessible to the contacts **62**.

With the board B_2 in the initial position, the latch **14** is advanced rectilinearly with respect to the housing from the open position (shown in FIG. **1**) toward the latched position (shown in FIG. **2**). The imposition of a closing force on the latching member **14** acting in direction of the arrow **82** (FIGS. **2**, **6** through **8**) unseats the detents **74A** and **74B** from their respective upper latch grooves **36A** and **36B**. Continued application of the closing force causes the detents **74A** and **74B** to ride along the respective inclined cam surfaces **34A** and **34B**. As the latching member **14** is so displaced, the cantilevered springs **80** impose a displacing force in the direction of arrow **84** (FIG. **6**) on the undersurface of the board B_2 thereby displacing the same in that direction with respect to the housing from the initial position (FIGS. **1**, **4** and **6**) toward the final position (FIGS. **2**, **5** and **8**). In the final position, the lateral edges of the board B_2 are engaged substantially throughout their length against the abutment surfaces **28A** and **28B**.

As the latch **14** moves toward the latched position the bias springs **80** simultaneously urge the board B_2 along the shelf toward the abutting position. At a predetermined point in the board's travel a portion of the surface of the board contacts the contacting surface **62C** of each of the contacts **62**. This initial contact of the board B_2 with one of the contacts **62** is shown schematically in FIG. **6**.

Thereafter, continued advancement of the board causes the section **62S** to flex about the bends **62L** and **62M** and to thereby pivot the contacting surface **62C** and cause the same to move across a portion of the surface of the associated conduction path in a wiping direction indicated in FIGS. **6** and **7** by reference arrow **88**. The wiping action of the contacting surface **62C** continues until the guide surface **62G** engages the camming wall **52** within the recess **46**. At this time, the contacting surface **62C** has wiped and scraped the surface of the conducting path for a vertical distance measured along the path between the points A (where the contacting surface **62C** first contacts the path, as in FIG. **6**) to the point B (wherein the guide surface **62G** engages the camming wall **52**, as shown in FIG. **7**).

Continued displacement of the board B_2 to the abutting position causes the guide surface **62G** on the contact **62** to slide along the camming surface **52** in the direction of arrows **90** (FIG. **7**), thereby imposing a backwiping action by the contacting surface **62C** across the conduction path on the board. With the board B_2 in the final position against the board abutment surface **28**, the contacting surface **62C** on the contact **62** is presented against the portion of the conduction path at some freshly scraped location C intermediate the points A and B.

When the latch is displaced along the inclined cam surface **34** to the latching position, the detents **74A** and **74B** thereon engage the lower latching grooves **36A** and **36B**, thereby securing the latched member in the latched position. The bias force imposed by the biasing springs **80** serves to maintain the board B_2 into snug abutting engagement with the abutment surfaces **28A** and **28B**. It is noted that variations in the thickness of the board B_2 may be accomodated in accordance with the present invention by the provision of the bias spring **80**. Moreover, the bias force as imposed by the springs **80** is selected so that at all times the bias force imposed by the springs **80** in the direction of the arrows **84** is greater than the opposing force imposed on the surface of the board by the resiliency of the contacts **62**.

Those skilled in the art, having benefit of the teachings hereinabove set forth, may readily appreciate that a zero insertion force connector has been provided which is especially adapted for use with ceramic surfaced or porcelain-on-steel circuit boards. The connector is arranged such that in the open position a board may be readily introduced and received by the connector at an initial orientation such that the board is noninjuriously received within the connector. Thereafter, rectilinear displacement of the latch from the open to the latched position causes the board to displace with respect to the housing from the initial to the final position. At some intermediate point during the displacement of the board the surface of each conduction path thereon is brought into contact with a resilient contact. Continued displacement of the board generates movement by the contact in a wiping direction over the surface of the conduction path, thereby scraping any accumulated foreign matter or dielectric film which may be present on the conduction path. Further progressive advancement of the board within the housing moves the contact over the conduction path in a backwiping direction such that the contact is brought to rest against a freshly scraped portion of its associated conduction path when the latch is latched and the board positioned in the final abutment position.

Those skilled in the art having benefit of the teachings as hereinabove set forth may effect numerous modifications hereto. However, it is to be understood that such modifications lie within the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A zero insertion force connector for electrically engaging a conduction path disposed on a substrate comprising:

a dielectric housing having an abutment surface thereon, the housing being adapted to receive a substrate introduced edgewise thereinto and to support the same in an initial position in which the substrate is inclined slightly with respect to the abutment surface;

an electrically conductive contact mounted within the housing;

a latch rectilinearly vertical displaceable with respect to the housing from an open to a latched position, the latch displacement direction and substrate introduction direction being substantially the same, displacement of the latch to the latched position imposing a displacing force on the substrate to move the same with respect to the housing from the initial to a final position in which the substrate abuts the abutment surface;

displacement of the latch progressively moving the substrate into engagement with the contact to cause the same sequentially to pivot with respect to the housing and to move across the conduction path in a wiping direction and thereafter to slide with respect to the housing and to move across the conduction path in a backwiping direction to present a portion of the contact in contacting relationship with a freshly wiped portion of the conduction path.

2. The connector of claim **1** wherein the housing has an inclined cam surface thereon along which the latch is slidable such that rectilinear displacement of the latch with respect to the housing generates the displacing force on the substrate.

3. The connector of claim **2** wherein the housing has a groove therein and the latch has a detent thereon such that the detent engages the groove when the latch is in the latched position.

4. The connector of claim 1 wherein the housing has a planar shelf defined thereon which supports the substrate as it moves from the initial to the final position.

5. The connector of claim 2 wherein the housing has a planar shelf defined thereon which supports the substrate as it moves from the initial to the final position.

6. The connector of claim 3 wherein the housing has a planar shelf defined thereon which supports the substrate as it moves from the initial to the final position.

7. The connector of claim 1 wherein the latch has a bias spring thereon, the bias spring being adapted to exert the displacing force on the substrate to move the same from the initial to the final position as the latch is displaced rectilinearly with respect to the housing from the open to the latched position.

8. The connector of claim 7 wherein the housing has an inclined cam surface thereon along which the latch is slidable such that rectilinear displacement of the latch causes the bias spring to engage against the substrate and to generate the displacing force thereon.

9. The connector of claim 8 wherein the housing has a groove therein and the latch has a detent thereon such that the detent engages the groove when the latch is in the latched position.

10. The connector of claim 9 wherein the housing has a planar shelf defined thereon which supports the substrate as it moves from the initial to the final position.

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